**International Journal of Civil Engineering and Technology (IJCIET)**
Volume 7, Issue 1, Jan-Feb 2016, pp. 199-210, Article ID: IJCIET_07_01_017
Available online at
http://www.iaeme.com/IJCIET/issues.asp?JType=IJCIET&VType=7&IType=1
Journal Impact Factor (2016): 9.7820 (Calculated by GISI) www.jifactor.com
ISSN Print: 0976-6308 and ISSN Online: 0976-6316


# RISK LEVEL ASSESSMENT ON ROAD CONSTRUCTION'S CONTRACTORS USING CULTURAL – PROFESSIONALISM BASED APPROACH

**Basyar Bustan**

Doctoral student, Department of civil Engineering, Faculty of Engineering, Hasanuddin University, South Sulawesi Indonesia

**Lawalenna Sammang, Nurali and Isran Ramli**

Lecturer, Department of civil Engineering, Faculty of Engineering, Hasanuddin University, South Sulawesi Indonesia,

## ABSTRACT

*This study aimed to analyze the characteristics of potential risk and the risk levels to the contractors in a road construction project and its impact on service providers (contractors), and to make a risk assessment model with multi-criteria to the contractors in road construction projects. Objective contractors road construction is not optimal due to non-performance risk management in the project with the right. This study is done in the form of a survey by capturing the opinions or perceptions, experiences and attitudes of respondents implementing on road construction. Parameters indicating the risk of road construction projects were model and tested using the methodology of Expert Choice to describe, quantify and demonstrate the risk level, allocation, and response in road construction projects with different risk variables. Results of the study firstly identified 281 risks for the road construction including 57 non-technical, 39 technical, 36 financial, 76 cultural, 38 work health and safety management aspect and 35 environmental aspects. Secondly the weight of the objective indicators on the risk of road construction work was assessed for cost 0.370, time 0.252, quality 0.184, work health and safety management 0.120, and environmental 0.074. The weight of objective criteria for cost risks was also assessed for non-technical 0.113, technical 0.247, financial 0.185, cultural 0.304, work health and safety management 0.083 and environmental 0.068 aspects. Thirdly risk map was divided into 116 extreme risks (41.28%), 153 high risks (54.45%), 12 medium risks (4.27%) and none of the low risk. Fourthly risk allocation was determined for contractors 53.19 (55.88%), sharing risks 22.30 (23.58%) and owners 19.52 (20.55%). Finally alternatives of strategy to handle the response*

*risk for road construction projects covered 36. 03 risk retention, 19.82 risk reduction, 26. 47 risk avoidance and 16.90 risk transfer.*

**Key words:** Risk Management, Risk Level, Construction Culture, Road Contractors

**Cite this Article:** Basyar Bustan, Lawalenna Sammang, Nurali and Isran RamliRisk Level Assessment on Road Construction's Contractors Using Cultural – Professionalism Based Approach, *International Journal of Civil Engineering and Technology*, **7**(1), 2016, pp. 199-210.
http://www.iaeme.com/IJCIET/issues.asp?JType=IJCIET&VType=7&IType=1

## 1. INTRODUCTION

Currently, the population of Indonesia has reached ± 252.165 million [1]. That number, which belongs to the labor force, reached 113.89 million people or around 49.13% of the entire population of Indonesia. Indonesia working population reached 104.87 million people or around 45.24% of the entire population in Indonesia. Most workers in Indonesia are working in the informal sector, that is 67.86 million and only 32.14 million are working in the formal sector [2]. Number of contractors in South Sulawesi province are 6300 companies, consisting of 4092 small companies with K1 qualification or around 64.95%, 775 companies with K2 qualification or around 12.30%, 538 companies with health and safety qualification or around 8.54%, 613 companies with M1 qualification or 9.73%, 228 medium-sized companies with M2 qualification or 3.62%, 48 large companies with B1 qualification or 0.76%, and 6 companies with B2 qualification or 0.10% [3].

The role of infrastructure becomes very important in supporting the economic growth and development of the country. World Bank, emphasized the importance of the infrastructure in the country's development, and how countries in the world to invest efficiently and effectively. Infrastructure development budget each year has increased. In 2014 the government budgeted around Rp188, 7 trillion for infrastructure development. The budget rose to Rp4.4 trillion from the state budget in 2013 which was around Rp184, 3 trillion. Compared to the total state spending in 2014, which reached Rp1.816, 7 trillion, the infrastructure budget allocation got a portion of 10.4% [4].

Throughout the years of 2010 - 2013, the government disbursed fund about Rp 4.564 trillion for road and bridge's construction in South Sulawesi, with details as follows: in 2010 was USD 722.31, year 2011 was Rp 826.53 billion, in 2012 was Rp 975, 71 billion, in 2013 was Rp 1.04 trillion, in 2014 was Rp 1.00 trillion. Estimated funding of RPJMN 2015-2019 for the road sector was Rp 340 trillion from the state budget, Rp 200 trillion from the local sate budget, Rp 65 trillion from the state-owned enterprises and Rp 200 trillion from the private sector with the target in the 2019 that the national road quality will reach 100% of standard quality road [4].

The quality of road construction indicates the amount of construction that is not in accordance with specifications, failure to achieve steady road conditions, and the design life of the road is not optimal, and the number of road construction project execution exceeds the execution time of the contract. National road quality is not stable in the Sulawesi region is likely to increase in the period 2005-2010. In 2010, of the total road length of 7426.84 km as many as 1,445 km condition is not steady (19.46 percent). The roads are not steady at 39.32 percent categorized as minor damage and 60.68 percent were severely damaged. National road quality is not steady

in South Sulawesi province is likely to increase in the period 2005-2010. In 2010, of the total road length of 1066.5 km length of roads with steady state along 676.44 km, or approximately 63.42%, and as much as 390.21 km condition is not steady 36.58 percent. The roads are not steady at 13.86 percent categorized as minor damage and 86.14 percent were severely damaged. Well above the average of Sulawesi [4].

Considering this great budget, its spending should be implemented efficiently and effectively by strategic implementation of infrastructure development so that the efficiency and effectiveness of cost, time, quality, safety, and environmental and other objectives can be achieved optimally. If this is not achieved then it will result in huge losses. Infrastructure development, the same as the other projects, is always overshadowed by the risk of failure. The larger the infrastructure projects are handled, the greater the risk challenge is. Studies conducted at the University of Aalborg [5] shows that in its history, the large-scale infrastructure projects have a high potential to undergo cost overruns and various other risks [6].

Risk management in infrastructure development projects have been started, although generally is still very limited to the economic aspect, which is certainly not enough. The perpetrators in infrastructure projects should also be able to apply risk management in all aspects of the potential risks that may cause harm to the contractor. The Indonesian government has sought a way to implement risk management and has made a policy by issuing regulations to carry out a wide range of risk management in the framework of internal control of the government. Applying the Government Internal Control System (known as "SPIP"), as stipulated in Government Regulation No. 60 of 2008 as a guide in the control over the implementation of infrastructure public works and settlement, which includes five elements: environment control, risk assessment, control activities, information and communication, and monitoring internal control. [7]

To sharpen the implementation of risk management in any construction work, the minister of Public Works has instructed his staff in accordance with the instruction minister of Public Works No.02/IN/M/2011. The instructions include the implementation of risk management through the process of establishing the context, risk identification, risk analysis, risk evaluation, risk management, monitoring and review, communication and consultation. Despite the fact that these instructions have not been implemented optimally and sustainably includes the road construction works.

Implementation of the project development activities in the construction services business faced with several constraints as well as the risk of a very major objective namely cost, time, quality and safety and the environment. The successful implementation of a project carried out by the construction company associated with the extent to which these risks can be well controlled.

One risk that is considered to be very influential in the construction industry in addition to technical and non technical aspects is the risk of corruption, this risk is categorized as a crime that is extraordinary, and this risk is prevalent in every stage of the project. Indication of the corruption during the process of these activities is some government projects which are not timely, well targeted, not right in quality and inefficient. Corruption that lasted so long would be very detrimental to the cultural construction. This corruption behavior can occur because of individual behavior aspect, organizational aspects of governance, aspects of the legislation, monitoring aspect, procurement aspect, and implementation aspect [8]. Study of the World Bank (World Bank) said that one of the obstacles of infrastructure development is

corruption. In fact, corruption in infrastructure is very high in number, up to 40 percent [9]. Corruption Perception Index (CPI) 2012, released by Transparency International Indonesia (TII) shows the country is still not out of the culture of corruption that has been ingrained. It is seen from IPK of Indonesia which is slipped from 110 to 118 [10].

Another challenge for the construction industry is the health and safety risks. Labor during working activity is always interacting with hazardous factors that exist in the workplace, which can not be avoided by labor as jobs in the construction industry should be handled directly by the workforce, so that a common problem is the emergence of occupational health and safety problem such as accident at the workplace.

Every year around the world, 2 million people die by work-related problems. This number, 354 000 people suffered fatal accidents. Ironically, every year there are 270 million workers who suffered occupational accidents and 160 million occupational diseases. Costs for occupational hazard are huge. The ILO estimates that the losses suffered as a result of accidents and occupational diseases each year more than US $ 1.25 trillion, equal to 4% of the Gross Domestic Product (ILO, 2003) [11].

Research of World Economic Forum in 2006 stated that the number of deaths due to accidents in Indonesia reach 7-18 for every 100,000 workers, not to mention the calculated losses and the consequences of the accident, both for managers and project implementers as well as workers and families [12].

Results of the research on occupational accidents in the construction industry have showed that the risk of workplace accidents becomes very important note to be controlled. Occupational health and safety risks are necessary to be observed in order to achieve successful implementation of construction projects. Occupational health and safety risks and the impact on labor, government actually has drawn up regulations in the form of legislation to the implementation guidelines health and safety of the construction of public works [13]. The problem is that the parties concerned have not been optimally implementing these rules consistently.

Other problem that often occurs in road construction is a matter of environmental risks. Infrastructure development has two sides that should be noted, they are aspect of development objectives and impact. Any development activity that undertaken certainly have an impact on the environment by both positive and negative impact, the one that should be considered is how to carry out the construction to obtain maximum results and benefits with the negative impact on the environment is minimum.

Government, in this case is the public works department has a lot of issuing regulations and guidelines for environmental management of roads [14], but the problem is the management of environmental risks in road construction works have not been planned and implemented well**.**

Considering the high risk potential results obtained from research study and a huge investment and the impact on the parties associated in the project, it is very necessary to study the contractor's risk assessment models of road construction which integrates behavior and professionalism.

# 2. LITERATURE REVIEW

## 2.1. Risk definition

All construction activities inevitably face many risks either directly or indirectly [15]. Risk is the chance of something happens in circumstances, events, incidents in the process of business activities, which could be impacting negatively on the achievement of business objectives that have been set. Risk is a condition where there is a possibility of profit or economic or financial loss, damage or physical injury, or delay, as a consequence of the uncertainty over the work implementation [16].

The concept of risk in construction projects is a measure of the probability and the consequences of not reaching a predetermined target project. Risk is the cumulative effect of the occurrence of an uncertain event that is detrimental affect on project objectives. The risk is an occurrence of a process, which management cannot be surely calculated both with its impact and magnitude of the the impact [17]. Uncertainty is a condition where there is a lack of knowledge, information, or an understanding of the decision and its consequences. The higher the level of the uncertainty, the higher the risk is [18]. Risk arises because of the uncertainty, because uncertainty will result in hesitance [19].

Risk extends along between two extremes, namely the full information and no information at all. The extreme end of the most risky is no information at all, or so-called unknown-unknown, in such conditions occur uncertainty in total, while the ends of the least risky is the complete information or called known, in these conditions occurs uncertainties total, while the the middle condition when some informations are be availabel or called known-unknown, and in this condition occurs two circumstances, namely the uncertainty in general but there is no certainty to any particular case. Occurrences in the future can not be known with certainty [15].

## 2.2. Risk management

**Risk management** is an activity undertaken to respond to risks that have been known to minimize the adverse consequences that may arise. Definition of risk management as all series of activities related to risk, could include risk management planning, risk identification, risk analysis, management and monitoring of risks. Risk management is an organized approach to find potential risks as to reduce the occurrence of unexpected things and its unxpected bad impacts can be known [20].

Risk management process is a preventive action where the real business conditions may become clear in advance and a greater failure can be avoided. Through risk management, we will know the proper method to avoid or reduce the magnitude of the losses suffered as a result of the risk

**Risk identification** is the selection of risk that may have an impact on the project and document storage based on their characteristics. Risk identification serves to get areas and technical processes that have a potential risk for subsequent analysis.

**Risk analysis** with the impact probability matrix is made in the following categories; low risk (L), control and monitoring, adequate with the normal act, moderate risk (M) requires identification and control of all the factors that contributed to a reassessment of the condition of project monitoring stages, high risk (H) may delay the project schedule or significantly affect the technical performance and cost, and risk management is needed, as well as extreme risk (E), the events that may lead

to a failure, unacceptable costs swelling, schedule delays which result in a project failure.

**Risk allocation** is the risk-sharing projects with the basic principle that the risk is shared and imposed to the most competent party to manage the risks. The allocation of risk includes the sharing of project risks between the contractor and the owner based on the principle of risk allocation. The principle of risk allocation is that the most able party to control a certain risk should also bear the risk.

**Risk response**, after a risk analysis then a risk management strategy is made, that is; avoiding the risk, when the impact is very large and massive, and the company is not being able to control it, the risk is transferred, if the risk can be covered by others, either through insurance or submitted subcontractor specialists, the risk had reduced by itself, if the company is confident of being able to control with some careful planning. Risk reduction could be done by reducing its likelihood, reduce its impact or both [21].

## 2.3. Analytical Hierarchy Process

The basic principle of Analytical Hierarchy Process according to Saaty (1993), the basic principle in the process of preparing the model in AHP analytic hierarchy: problem decomposition, comparative judgement, synthesis of priority, and logical consistency.

## 2.4. Conceptual framework

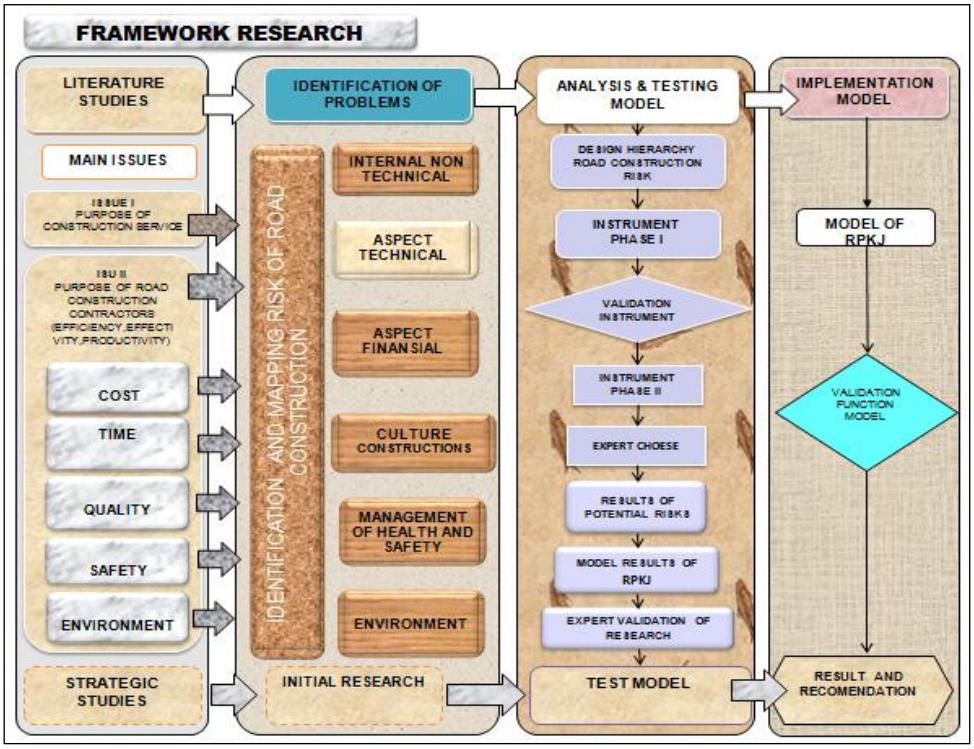


**Figure 1** Conceptual framework of the research

# 3. RESEARCH METHODOLOGY

## 3.1. Location and time of the research

This research had been conducted in the province of South Sulawesi. The sample to be studied is the contractor in a road construction project. This research was conducted at the provider, in this case is the contractor in the field of road transport services with contractor qualification of medium scale (M1 and M2) and high (B1 and B2) with the number of 95 respondents.

## 3.2. Research design

Conducting survey, literature review and risk identification, performing initial testing that supports the topic of risk management on road construction projects, drafting the models and research instrument, Figure 1, performing risk management analysis on the project road construction; risk identification, risk analysis, risk response, control of risk, and the results and recommendations. Solving the problem of road construction risks by using AHP takes the following steps; define problems and set goals, organize the problem into a hierarchical structure so that complex problems can be seen in detail and measurable, set priorities for each element of the problem in each hierarchy. This priority is generated from a matrix of pairwise comparisons between all elements at the same hierarchical level, to test the consistency of the comparison between elements obtained at each level of the hierarchy deviation of consistency which is expressed in an index of consistency [22].

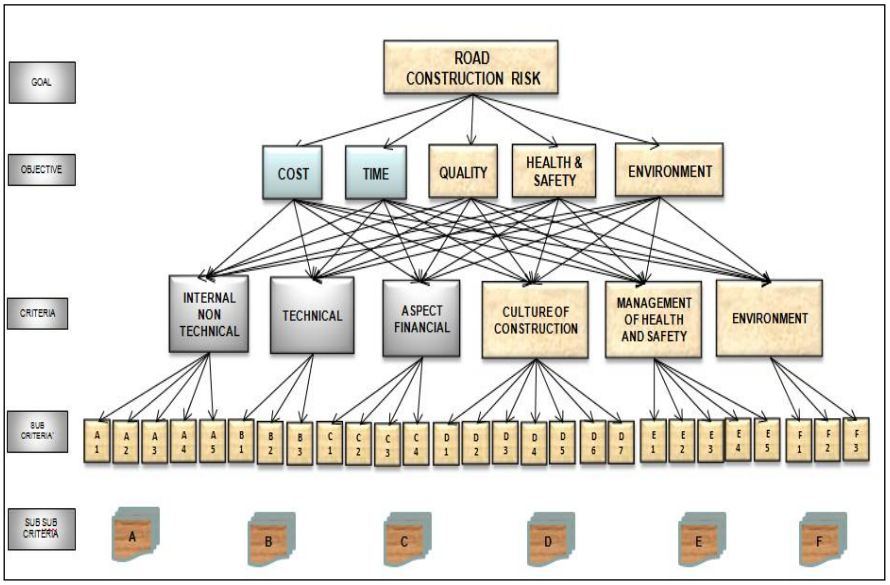


**Figure 2** Hierarchy of implementer risk of road construction

$CI = \frac{\lambda maks^{-n}}{n-1}$ , Where: n = matrix size, $\lambda_{maks}$ = max *eigenvalue* (1)

Consistency index (CI), random matrix with research scale 1 to 9, and its opposite as random index (R1). Based on the calculation of Saaty with 500 samples, if the numerical judgments had taken randomly from the scale 1/9, 1/8, 1, 2, 9.

CR = CI /RI (2)

Where: CR = Consistency Ratio, Consistency Index, RI= Random Index

# 4. RESULTS AND DISCUSSION

## 4.1. Risk identification

A number of risks were identified for the road construction as much as 281 risks and were grouped into non-technical aspect 57 risks, technical aspects 39 risks, financial aspect 36 risks, cultural construction aspect 76 risks, health and safety management aspect 38 risks and environmental aspect 35 risks.

## 4.2. Assessment and weight level of risk

**Table 1** Weight of objective risk

| NO | Objective risk | Weight | Rank |
|---|---|---|---|
| 1 | Cost | 0,370 | 1 |
| 2 | Time | 0,252 | 2 |
| 3 | Quality | 0,184 | 3 |
| 4 | Health and safety Management | 0,120 | 4 |
| 5 | Environment | 0,074 | 5 |

**Table 2** Risk weighting criteria

| CODE | Criteria | Weight | Rank |
|---|---|---|---|
| A | Non-technical aspect | 0,113 | 4 |
| B | Technical aspect | 0,247 | 2 |
| C | Financial aspect | 0,185 | 3 |
| D | Construction cultural aspects | 0,304 | 1 |
| E | Health and safety management aspect | 0,083 | 5 |
| F | Environmental aspect | 0,068 | 6 |

**Table 3** Weight of sub criteria A non-technical aspect

| CODE | Sub criteria | Weight | Rank |
|---|---|---|---|
| A1 | Planning | 0,335 | 1 |
| A2 | Organizing | 0,254 | 2 |
| A3 | Directing | 0,083 | 5 |
| A4 | Supervising and evaluating | 0,182 | 3 |
| A5 | Legal aspect | 0,125 | 4 |

**Table 4** Weight of sub criteria and technical aspect

| CODE | Criteria | Weight | Rank |
|---|---|---|---|
| B1 | Project characteristics | 0,281 | 3 |
| B2 | Owner characteristics | 0,150 | 2 |
| B3 | Construction Implementation | 0,568 | 1 |

**Table 5** Weight of sub criteria C financial aspect

| CODE | Sub Criteria | Weight | Rank |
|---|---|---|---|
| C1 | Financial uncertainty and cash flow | 0,134 | 4 |
| C2 | Project costing | 0,409 | 1 |
| C3 | Market risk | 0,201 | 3 |
| C4 | Fraud | 0,256 | 2 |

**Table 6** Weight of sub criteria D cultural aspect of construction

| CODE | Sub Criteria | Weight | Rank |
|---|---|---|---|
| D1 | Individual behavior r aspect | 0,206 | 2 |
| D2 | Governance organizational aspect | 0,315 | 1 |
| D3 | Law and regulation aspect | 0,050 | 7 |
| D4 | Supervision aspect | 0,091 | 5 |
| D5 | Procurement aspect | 0,146 | 3 |
| D6 | Implementation aspects | 0,074 | 6 |
| D7 | Local features | 0,119 | 4 |

**Table 7** Weight of sub-criteria E healthy and safety management aspect

| CODE | Sub Criteria | Weight | Rank |
|---|---|---|---|
| E1 | Health and safety policy | 0,343 | 1 |
| E2 | Health and safety planning | 0,231 | 2 |
| E3 | Application and operating activities | 0,194 | 3 |
| E4 | Examination | 0,140 | 4 |
| E5 | Management review | 0,092 | 5 |

**Table 8** Weight of sub criteria F environmental aspect

| CODE | Sub Criteria | Weight | Rank |
|---|---|---|---|
| F1 | Preparation of Construction works | 0,179 | 3 |
| F2 | Implementation of construction works | 0,346 | 2 |
| F3 | In work site base camp | 0,475 | 1 |

Analysis results of risk management that have been done, the empirical findings obtained in this study are about 281 variables were identified, extreme risk was about 116 risks or 41.28%, high risk was about 153 risks or 54.45 %, medium risk as much as 12 risks or 4.27%, low risk was not available. Around 57 sub-indicators were identified for non-technical risks are extreme risk as much as 16 risks or 28.07%, high risk as much as 29 risks or 50.88%, medium risk as much as 12 risks or 21.05%, and low risk was not available. Around 39 sub-indicators were identified for technical risks are extreme risk as much as 24 risks or 61.54%, high risk as many as 15 risks or 38.46%, medium risk and low risk were not available. around 36 sub-indicators were identified for financial risks are extreme risk as much as 15 risks or 41.67%, high risk as many as 21eisks or 58.33%, medium risk and low risk were not available. Around 76 sub-indicators were identified for construction cultural aspect are extreme risk as much as 45 risks or 59.21%, high risk as many as 31 risks or 40.79% medium risk and low risk were not available. A total of 38 sub-indicators were identified for the risk management of health and safety are extreme risk as much as 10 risks or 26.32%, high risk as many as 28 risks or 73.69% medium risk and low risk were not available. A total of 35 sub-indicators were identified for environmental aspect are extreme risk as much as 6 risks or 17.14%, high risk as much as 29 risks or 82.86%, medium risk and low risk were not available.

## 4.3. Risk allocation

Allocation risk of road construction works for the contractor as much as 53.19 or 55.88%, divided around 22.30 or 23.58% and the owner as much as 19.52 or 20.55%. The average allocation of risk (A) non-technical aspect of the contractor parties as much as 59.00 or at 61.95%, shared around 20.60 or 21.99% and the owner as much

as 15.40 or 16.12%. The average allocation of risk (B) for technical aspect of the contractor parties as much as 49 or as much as 51.49%, divided around 23.33 or 24.56% and the owner as much as 15.31 or 23.96%. The average allocation of risk (C) financial aspect for the contractor as much as 65.75 or 69.06%, shares around 18 or 18.85% and the owner as much as 11.25 or 12.09%. The average risk allocation (D) for construction cultural aspect of the contractor parties as much as 36.43 or at 38.29%, shared ar 24.57 or around 6.02% and the owner as much as 34 or 35.69%. The average allocation of risk (E) healthy and safety management aspect for the contractor as much as 59.20 or 62.17%, divided around 23.40 or 24.64% and the owner as much as 12.40 or 13.18%. The average allocation of risk (F) environmental aspect for the as much as 60.00 or 63.14%, shared around 22.67 or 24.07% and the owner as much as 12.33 or 12.79%.

### 4.4. Risk response

The alternative strategy of handling the response risk for road construction projects are bearing retention the risk with an achievement of as much as 36.03 or 38.73%, reduction the risk as much as 19.82 or 19.01%, avoiding the risk as much as 26.47 or 28.13%, and transferring the risk as much as 16.90 or at 15.17%. The average alternative strategies for handling the risk response for (A) non-technical aspect are by bearing retention the risk with an achievement of as much as 39.57 or at 41.65%, reduction the risk as much as 14.27 or 15.02%, avoiding the risk as much as 38.27 or 40. 28%, and transferring the risk as much as 2.90 or 3.05%. The average alternative strategies for handling the risk response for (B) technical aspect are bearing retention the risk with an achievement of as much as 36.69 or 38.62%, decreasing reduction the risk as much as 27.88 or 29.34%, avoiding (avoidance) the risk as much as 19.97 or 21.02%, and transferring the risk as much as 10.47 or 11.02%. The average alternative strategy for risk management responses for (C) financial aspect, namely by bearing retention the risk with an achievement of as much as 18.58 or at 19.55%, reduction the risk as much as 24.98 or 26.30%, avoiding the risk as much as 35.23 or 37.08%, and transferring the risk as much as 16.26 or 17.12%. The average alternative strategies for handling the risk response for (D) construction cultural aspect are bearing retention the risk with an achievement of as much as 10.22, or 10.75%, reduction the risk as much as 8.23 or 8.67%, avoiding the risk as much as 41.91 or at 44.12%, and transferring the risk as much as 34.64 or 36.46%. The average alternative strategies for handling the risk response for (E) healthy and safety management aspect are bearing retention the risk with an achievement of as much as 80.20 or 84.42%, reduction the risk as much as 14.26 or 15.01%, avoiding the risk as much as 0.00 or of 0.00%, and transferring the risk as much as 0.55 or 0.57%. The average alternative strategies for handling the risk response for (F) environmental aspect are bearing retention the risk with an achievement of as much as 46.27 or 48.70%, reduction the risk as much as 34.61 or 36.44%, avoiding the risk as much as 3.10 or 3.26%, and transferring the risk as much as 11.02, or 11.60%.

## 5. CONCLUSIONS AND SUGGESTION

### 5.1. Conclusions

1. The number of risks were identified for the road construction is 281 risks which are grouped into non-technical aspect 57 risks, technical aspect 39 risks, financial aspect 36 risks, construction cultural aspect 76 risks, healthy and safety management aspect 38 risks and environmental aspect 35 risks.

2. Weight of the objective importance from the indicator on the risk of road construction works, namely cost 0.370, time 0.252, quality 0.184, health and safety management 0.120, and environmental 0,074, for the level of objective criteria on cost aspect of non-technical 0,113, technical aspect 0.247, financial aspect 0.185, construction cultural aspect 0.304, health and safety management aspect 0.083 and environmental aspect 0.068. The extreme risks were 116 risks or 41.28%, high risk as many as 153 risks or 54.45%, medium risk as much as 12 risks or 4.27%, low risk was not be available. Allocation risk of road Construction works for the contractor as much as 53.19 or 55.88%, shared) around 22.30 or 23.58% and the owner as much as 19.52 or 20.55%
3. The alternative strategy of handling the response risk for road construction projects are bearing retention the risk with an achievement of as much as 36.03 or at 38.73%, reduction the risk as much as 19.82 or 19.01%, avoiding the risk as much as 26.47 or at 28.13%, and transferring the risk as much as 16.90 or at 15.17%.

### 5.2. Suggestion

Risk management which has been searched is from the contractor's perspective; it is expected to continue the research by using the project of owner and the consultant's perspective. Indicators of safety in this study only consider aspect of safety management systems and leave out the variables with technical nature.

## ACKNOWLEDMENTS

We expressed many thanks to all those involved directly or indirectly in completing this paper. especially thanks for the government, the development agency of construction services (LPJK), the implementer of road construction, and the National Roads Rehabilitation Institution of South Sulawesi province and Hasanuddin University who have supported, and provided an opportunity for authors to conducting this research.

## REFERENCES

[1] Central Bureau of Statistics, The Development of Some of The Main Indonesian Socio-Economic Indicators Indonesia, Jakarta, 2014.

[2] Sedyaningsih, R.E. Policies Ministry of Health in the Health and Safety at Work, Papers Occupational Safety and Health Convention, Jakarta, 2010.

[3] Development Institution of Construction Service, South Sulawesi Province LPJK Report, Makassar, 2015.

[4] Center Office Implementation of National Road VI, Infrastructure development in South Sulawesi, Makassar, 2013.

[5] Flyvbjerg, B., Holm, M.K.S., Buhl, S.L., What Causes Cost Overrun in Transport Infrastructure Projects? Transport Reviews, 24(1), January, 2004.

[6] Hutabarat R., Application of Risk Control. Graduate program, Jakarta, 2008.

[7] Public Works Department, Implementation Of Government Regulation No. 60 Of 2008 Regarding to Internal Control System of Government, Jakarta, 2008.

[8] Wahyudi I., Sopana. Analysis of Factors Influencing Corruption at the Local Government Budget Unfortunate Highway, Malang Corruption Watch, 2005.

[9] Erani Yustika A., Infrastructure Development Constrained Corruption, Jakarta, 2012.

[10] Kompas. Higene Corporate Health and Safety, Jakarta 2012.

[11] Suma'mur. Higene Company and health work, Jakarta, 2009.

[12] Carlo, Nasfryza. Many Companies Neglect Health and Safety, Environmental Syudy postgraduate Bung Hatta University, 2011.

[13] Public Works Department, Procedures for the Preparation of Construction Health and Safety Public Sector for Service Providers, Jakarta 2000.

[14] Public Works Department, General Guidelines for Environmental Management of Road Sector Impacts, Jakarta,2006.

[15] Asianto. Production Management for Construction Services, Paramita, Jakarta, 2005.

[16] Kuldip Singh, R K Pandey, C S Mishra, Dr Y K Bind and A K Rai. Analysis on Utilization of Cement Kiln Dust Stabilized Red Mud for Road Construction, *International Journal of Civil Engineering and Technology*, **5**(8), 2014, pp. 56-61.

[17] Cooper, F.Dale, and Sthepen G., Project Risk Management Guidelines Managing Risk In Large Projects And Complex Procurements. Jhon Wiley. 2005.

[18] Dr. P. Sakthiselvan, Mrinimoy Jyoti Borah and Swathi, For Road Construction Using Examination of Fly Ash Cement, *International Journal of Civil Engineering and Technology*, **6**(10), 2015, pp. 126-131.

[19] Barrie dan Paulson. Project Management Institute (PMI), 1992.

[20] Ritchie, B. and Marshall, D., Business Risk Management, Chapman, London, 1993.

[21] Djamin Pedju M., Integrating Consideration VE and Risk Mmanagement Project Construction Phase Impact on Achieving Goals and Success of the Project, 2014.

[22] Kerzner H., Project Management A Systems Approach to Planning Scheduling and Controlling 10th Edition, Jhon Wiley, 2009.

[23] Flanagan Roger, and Norman G., Risk Management and Construction.2003.

[24] Saaty, Thomas L., Fundamental of Decition Making and Priority Theory with the Analitical Hierachi Procces. University of Pittsburgh, 1994.